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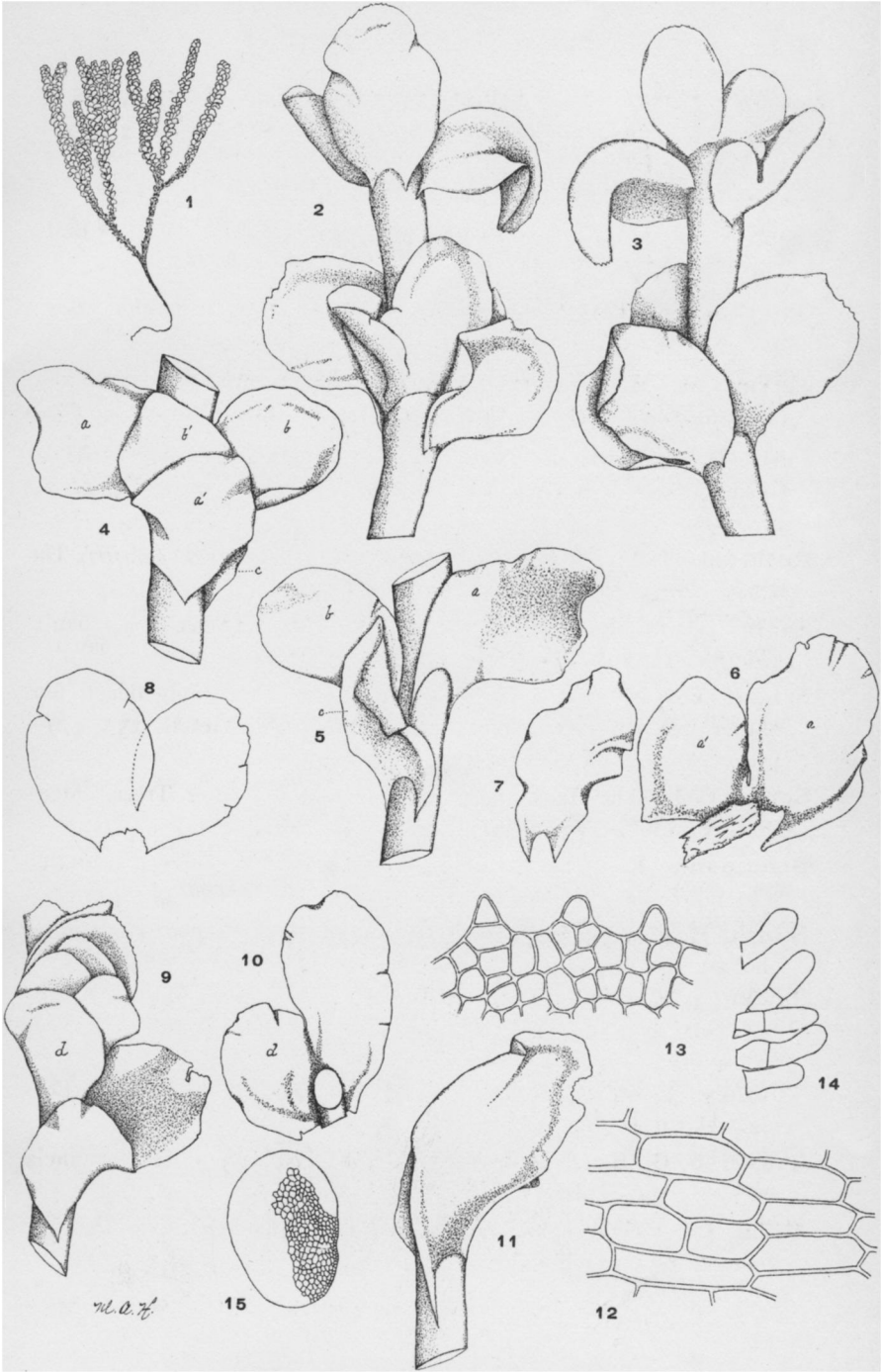
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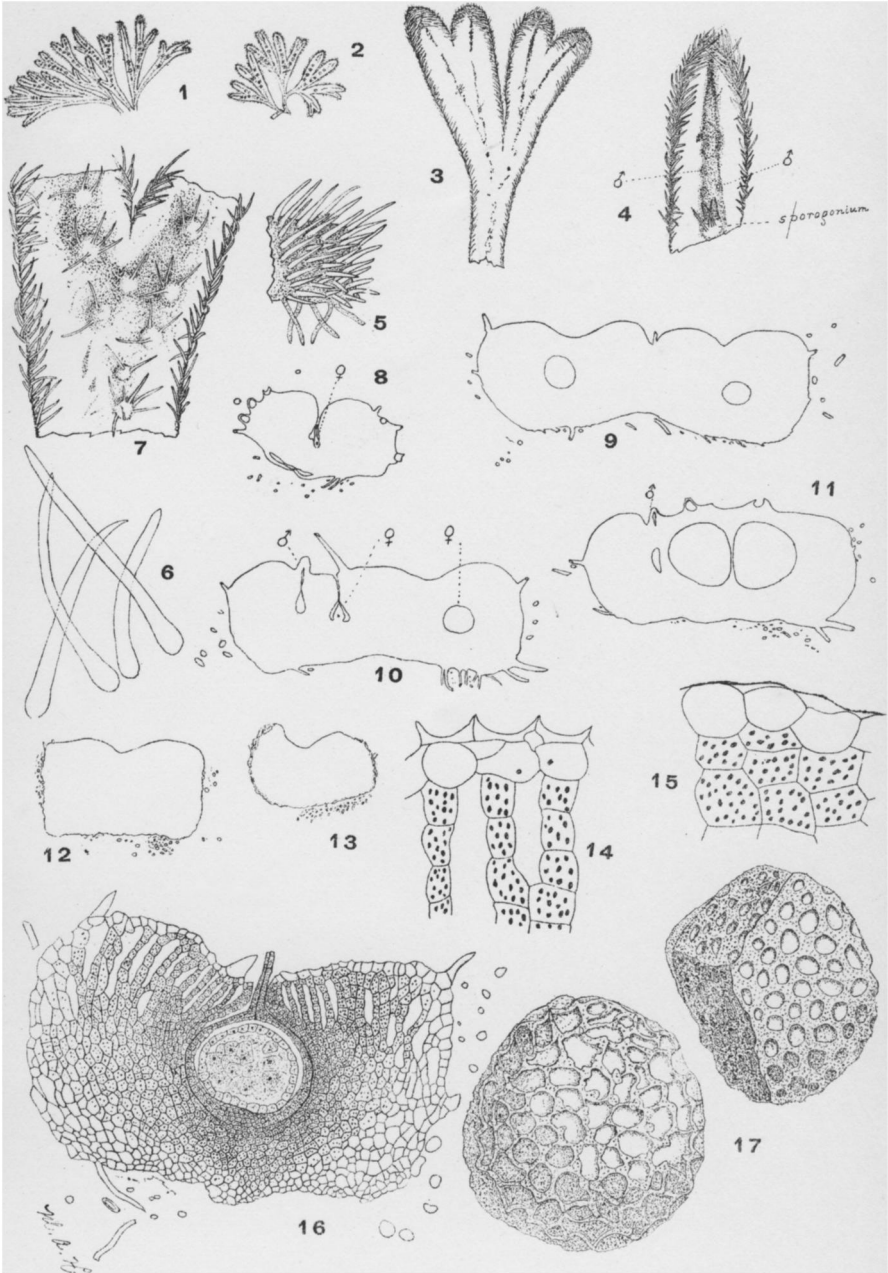
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SCAPANIA (?) HETEROPHYLLA M. A. Howe.



RICCIA TRICHOCARPA M. A. Howe.

New American Hepaticae.

BY MARSHALL A. HOWE.

(PLATES 336, 337.)

SCAPANIA (?) HETEROPHYLLA.

Plants obscurely complanate, dark green, often bleaching at apices on drying, erect or ascending, forming compact cushions: stems 4–6 cm. high from a rhizomatous base, rigid, fastigiately and subdichotomously branched, brown, becoming almost black, nearly or wholly destitute of root-hairs, denudate below, 20–30 cells in thickness: leaves scarcely increasing in size upward, sometimes smaller at the stem-apex, the upper erecto-patent, subimbricate, the lower approximate, more spreading, often with squarrose tips, all strongly undulate-cripsed both when moist and when dry, bilobed to the middle or bipartite, complicate, the carina acute or somewhat rounded, but never winged, the lobes sometimes almost disunited; now and then with an unlobed leaf irregularly interpolated, most frequently in the position of an underleaf; margins of the lower leaves commonly erose, of the upper entire or sparingly denticulate; ventral lobes twice as large as the dorsal or subequal, 1.7–2.5 mm. in length, .85–1.6 mm. in maximum width, broadly obovate, elliptical, or obovate-oblong, usually decurrent, mostly rounded-obtuse at apex; dorsal lobes obtuse, obliquely and broadly ovate or elliptical, not decurrent, sometimes appressed at stem-apex, especially on the younger shoots, but mostly ascending or slightly squarrose-reflexed: leaf-cells generally opaque, with smooth or slightly roughened cuticle, near the margin subquadrate or roundish-hexagonal, 16–28 μ , near the base oblong, 60–90 μ \times 25–30 μ ; trigones indistinct or wanting: remaining parts unknown. (Plate 336.)

On submerged stones in a cold mountain stream (alt. 3500 ft.) in company with *Chiloscyphus polyanthos rivularis* and *Porella rivularis*, Sisson, Siskiyou Co., California, July, 1894 (Howe, no. 34).

The stream, which is formed by a great spring beside the railway track about three-fourths of a mile north of the village of Sisson, is said to maintain nearly a uniform volume throughout the year, and as the plants were found wholly under water in the last

of July and the first of August, it is probable that their submersion is permanent.

The plant described above was referred at first, uncritically, to *Scapania undulata* and listed under that name in Erythea (4: 49. 1896). From *S. undulata*, however, it is certainly very distinct in the obscurely complanate branches, in the sometimes 3-ranked, often more deeply lobed, erecto-patent, never alate-carinate, leaves, with more or less squarrose tips, and in the obovate rather than round-trapezoidal ventral lobes. The interpolated unlobed leaves stand sometimes in about the general position of dorsal or ventral lobes, but more often squarely subtend the ventral surface of the stem. They can doubtless be explained in some cases, from the point of view of ontogeny, by the separation of the normally united lobes, but in other cases this hypothesis seems to find little justification. We have noticed one or two *three*-lobed leaves out of hundreds examined and in such the complete disjunction of the most ventral lobe would have thrown it nearly into the place of an underleaf. When the leaf-lobes are subequal it is often difficult to distinguish between the dorsal and ventral aspects of the stem, especially if further confused by the presence of the supernumerary entire leaves. From stems of such a character as this, however, may spring young shoots in which the leaves are regularly distichous and acutely complicate, in the ordinary *Scapania* fashion, with the ventral lobes twice the size of the dorsal. In the axils of the upper leaves are sometimes to be found numerous short clavate paraphyses, unicellular or of two or three oblong cells in a lineal series.

It is possible that the species deserves to be separated generically from *Scapania*, but in absence of perianth and sporogonium, we can do no better than refer it to a genus with which it surely has very much in common. Our material is sufficiently ample to allow its distribution at an early date in Underwood and Cook's *Hepaticae Americanae*.

RICCIA TRICHOCARPA.

Thallus in rosettes about 2 cm. in diameter or forming somewhat irregularly radiating masses; the principal divisions linear, 2-6 times dichotomous, .75-1.5 (mostly 1) mm. in width, often

black below and at margins, densely clothed at the sides with white or tawny setæ .3-.65 mm. long, those toward the apices often in as many as 8-12 irregular series, mostly distinct at insertion, with sharp, rigid, rarely slightly uncinat points, the terminal thalluslobes obtuse or oblong-elliptical, obtuse or subacute, narrowly and rather deeply unicanaliculate toward the apices or subbicanaliculate, the furrow at the extremities commonly concealed by the trichomes, the median sulcus sometimes nearly vanishing toward the base, margins obtusely rounded, tumid, often connivent on drying, the furrow then thatched by the somewhat forwardly directed setæ; dorsal surface light green, minutely and regularly reticulate; ventral surface nearly plane and flat, with a few very inconspicuous scales on either side of the median line at the apices, falsely squamose in the basal parts through delamination due to marcescence; width of transverse sections 1.6-3 times their height, the posterior subquadrangular with a light median sulcus, the margins becoming more tumid and rounded in proceeding toward the apex and the sulcus now and then double, the sections convex ventrally only in the extreme apical region; 20-28 cells in thickness, texture nearly solid, the air-chambers narrow and vertical; epidermis primarily bistratose, the superficial layer at first papillate, afterwards collapsed, and in the older parts reduced to a flattened cellulose membrane incumbent on the lower layer: monoicous: antheridia scattered, the ostioles elevated about .1 mm.: sporogonia numerous, in a single or double series, immersed, finally—especially when dry—hemispherical-protuberant above, together with the long-unruptured covering, or subconical, the covering marked with a dark-purple spot and bearing with rare exceptions 1-12 setae; spores soon black and very opaque, narrowly or not at all margined, 90-120 μ in maximum diameter, minutely granulose-papillate, with 9-12 areolae (visible only in the younger spores) across the convex face, the walls of these with irregularly thickened and salient angles, thus often giving this face in profile the appearance of bearing columnar or wart-like elevations, areolae across one of the plane faces 5-7 in number, scarcely elevated at the angles. (Plate 337.)

On rather dry and rocky soil. *California*: about San Francisco, "Mission Dolores," "Turk St.," "near Ocean House" (Dr. Bolander), Mission Dolores (Howe); Berkeley (Howe); Ukiah (Howe); San Mateo Co. (Prof. D. H. Campbell); Palo Alto (S. E. Brown); Santa Ana Hills (Parish); Pasadena (McClatchie).

Exsicc. Hep. Bor.-Am. 143^b (as *R. tumida* Lindenb.).

Hep. Am. 138 (as *R. arvensis* Aust., var. *hirta* Aust.).

The above is the Californian *Riccia* that has been referred variously by American authors to *Riccia ciliata* Hoffm., *R. tumida* Lindenb., *R. intumescens* Aust. MS., Underw. (*R. ciliata* Hoffm., var. *intumescens* Bisch.) and more recently to *Riccia hirta* Aust. (*R. arvensis* Aust., var. *hirta* Aust.). But *Riccia arvensis hirta** known only from Mr. Austin's specimens from the neighborhood of Closter, New Jersey, bears comparatively few, short, usually blunt-pointed and incurved papilla-like cilia .1–.3 mm. long (not *setae*), the thallus is strongly incrassate-carinate ventrally, the margins are acute, the epidermis is very thick, of 2 or 3 layers of

* The relationship of Mr. Austin's var. *hirta* of his *Riccia arvensis* to his *Riccia Lescuriana* is still obscure to us. A study of Hep. Bor.-Am. 141 (*R. arvensis*) and Hep. Bor.-Am. 143 (*R. Lescuriana*), which may fairly be considered the types of these species inasmuch as they were cited after the original diagnoses (Proc. Acad. Nat. Sci. Philad. 1869: 232. 1869), though not distributed until four years later, shows important differences between the two. *R. Lescuriana* is a larger plant, with longer and broader segments, and its spores are 75–100 μ in maximum diameter, with thick-walled, strongly defined areolae on the outer face, 7 or 8 measuring its width, the inner faces nearly smooth, minutely granulate-papillate, or very faintly and irregularly reticulate, while *Riccia arvensis* has somewhat smaller spores (70–90 μ) with all the faces distinctly and almost equally areolate. But Hep. Bor.-Am. 142, issued as *R. arvensis* Aust. var. *hirta* and cited by Mr. Austin after his original description of this variety, in Professor Underwood's set agrees with *R. Lescuriana* in every detail of importance; in the copy in the possession of Columbia University, however, we find a plant intermediate between the typical *R. arvensis* and *R. Lescuriana* both as to thallus- and spore-characters, mixed with *R. sorocarpa* Bisch. In all the specimens alluded to, the cilia when present are confined to the margin, though in the original description of the var. *hirta* (*l. c.*) we read, "*supra omnino hirta*," which, however, in the Hep. Bor.-Am. was changed to "*supra usitate hirta*." But there is, in the possession of Professor Underwood, a specimen labeled in Mr. Austin's handwriting simply, "Rocks, Palisades, N. J., C. F. A., Sept. 1863," in which the short cilia are not confined to the margin but are scattered over the dorsal surface. The spores in the latter are nearly like those of the typical *Riccia arvensis*, but there are differences in general habit, in the form of the lobes, and in the character of the median sulcus which make its reference to the same species doubtful. But whatever the relation of *R. arvensis hirta* to *R. Lescuriana*, none of the New Jersey specimens have anything to do specifically with the Californian plant described above.

It may be remarked that *R. Lescuriana* was considered by Lindberg (Musc. Scand. 2, 1879) a synonym of *R. Michelii* Raddi; but *R. Michelii* ("*typica* * * * *e loco classico*") according to a specimen which we owe to the kindness of Dr. Levier of Florence, has spores that are distinctly reticulate on the inner faces, while those of *R. Lescuriana* are typically quite otherwise as already indicated; moreover, *R. Michelii*, together with its varieties, is said by Dr. Levier to be always dioicous, while the American plant appears to be always clearly monoicous. The antheridial ostioles are equally prominent in both.

decolorate or purple-tinged cells, the somewhat smaller, more distinctly margined spores are fuscous-brown at maturity and always show their areolae quite clearly in glycerine instead of being densely black and opaque as in *R. trichocarpa* under the same treatment, the plants are mainly smaller and less frequently dichotomous, the thallus-segments are usually comparatively broader, reddish-purple below and more evidently squamigerous.

A much nearer ally of *Riccia trichocarpa* is doubtless *R. ciliata* Hoffm. of Europe. From the typical form of this, however, the Californian plant is clearly distinct in the shorter and much more abundant setae (these often reach 1 mm. in length in *R. ciliata*), in the presence of trichomes over the sporogonia, in the rather larger size of the thallus, more acute-angled dichotomy, and in the commonly black margins and sides. From *R. ciliata* var. *intumescens* Bisch., known to us only from the excellent figures and description of its author, our specimens evidently differ in the longer, narrower segments, in the even more crowded lateral setae, those toward the apex often in as many as 8–12 irregular series, and in the normal presence of 1–12 long trichomes above each sporogonium, while in regard to the “cilia” of *R. ciliata intumescens* Bischoff* says, “*rarius quoque in superficie frondis dispersa.*” In *R. ciliata*, the tissues covering the mature sporogonium soon become thin, scarious, and shining, and finally break away in fragments, exposing the capsule and the spores, and Bischoff remarks of the capsules of the var. *intumescens*: “*post maturitatem rupti, foveolas sporis repletas in frondis pagina superiore relinquentes*”; while in *R. trichocarpa* the covering of the capsules remains very long intact—indeed, in only one case out of several specimens with spores evidently much past maturity, have we seen the contents of a capsule exposed by natural agencies.

Riccia crinita Tayl. from Swan River, Australia (Drummond, no. 42), the original of which we have seen through the kindness of Dr. B. L. Robinson, is close to *R. trichocarpa* in character and number of setae, which also sometimes occur over the sporogonia. But *R. crinita* is a smaller plant, only 2 or 3 times dichotomous, with shorter, oblong rather than linear segments, the thallus is

* Acta. Acad. Caes. Leop. Carol. Nat. Cur. 17: 1063. 1835.

comparatively much thinner, the vertical sections of its segments being 3-7 times as wide as high, the margins are acute and commonly incurved; the spores (possibly not arrived at full depth of color) are light-brown, 75-90 μ in maximum diameter, with 11-14 smaller areolae across the convex face, this scarcely papillate in profile, the plane faces similarly areolate, the mesh-forming ridges throughout and the narrow margin nearly smooth.

Riccia Michelii Raddi, var. *ciliaris* Levier (= *R. tumida* Lindenb. and *R. palmata* Lindenb. *vide* Levier) differs so widely from our species that a detailed comparison is unnecessary.

R. trichocarpa may be found with archegonia and antheridia in January and early February, ripening its capsules in April and May. Like all the Californian *Ricciae*, it is practically invisible during the summer months.

It was our first thought to take up for this species the name *Riccia Bolanderi* Aust., which a fragment (presumably from the Herbarium of the California Academy of Sciences) now in the Underwood Herbarium is said originally to have borne, and we have already sent one specimen to Europe under this name. But, in one of the very last of the acute Mr. Austin's works—his descriptive treatment of the Hepaticae of California, prepared for the "Botany of California,"* but never published—he refers this plant, which he had previously distributed as *R. tumida* Lindenb. (Hep. Bor-Am. no. 143^b) to *R. intumescens*, raising Bischoff's variety of *R. ciliata* to specific rank, and without making any allusion to having at some time made use of an unpublished name, *R. Bolanderi*, for the same thing. This reference to *R. intumescens* would appear to have been Mr. Austin's final opinion in the matter, and under the circumstances it seems to us to be fairer to assume the responsibility of the attempt at disentangling this Californian *Riccia* from its various allies and to give it a name of our own choosing.

Hep. Am. 138, collected in San Mateo Co. by Prof. D. H. Campbell, we consider the type of the species.

* Brewer, Watson, and Gray, Botany of California (Geological Survey of California), 2 vols. 1880.

RICCIA LAMELLOSA Raddi, Opusc. scient. di Bol. 2: 351. *pl.* 15. *f.* 2. 1818.

Var. AMERICANA. Spores brown, 75–126 μ in maximum diameter, obscurely angular, wholly destitute of a wing-margin, with 8–12 clearly defined areolae, each about 15 μ in width, across the outer face, the inner faces marked with much smaller and less distinct areolae or simply with irregular vermicular lines.

California: San Francisco (Bolander, Howe); Fruit Vale, Alameda Co. (Miss Edith S. Byxbee). *New Jersey*: Closter (Austin). *Alabama*: Mobile (Mohr).

The principal peculiarity of the spore of the American *R. lamellosa* was first remarked upon by Professor Underwood (Bot. Gaz. 19: 274. 1894). The European plant has distinctly wing-margined and plainly angular spores, and the markings of the inner and outer faces are nearly uniform; the ridges of the outer face are more vermicular than in the var. *Americana* and less often form perfect areolae, and when the areolae are well defined, they are smaller and more numerous, 14 or 15 measuring the diameter of the outer face. For comparison we have made use of a specimen from Florence, Italy (the type locality), and one from Sicily, both kindly communicated by Dr. E. Levier.

The Alabama and New Jersey specimens show practically the same characters as the Californian with the exception that the spores of the latter are larger, ranging from 90–126 μ in greatest diameter, while in the eastern and southern plants they measure but 75–100 μ . The Californian plant appears to produce capsules rather sparingly.

ASTERELLA LATERALIS.*

Thallus simple, or innovating latero-ventrally or in front, mostly oblong to linear, 7–25 mm. \times 1.5–4 mm., rather effusely costate-carinate, about 25 cells thick in the middle, becoming very thin at the broad, brownish or decolorate and subpellucid, lightly undulate-crenulate margins, somewhat flatly and narrowly

* In accordance with the later practice of Lindberg and others, we use *Asterella* (Pal. de Beauv., 1810) for the genus to which Nees in 1820 gave the name *Fimbriaria*. *Asterella*, as has been recently pointed out by Professor Underwood (Bot. Gaz. 20: 59. 1895), is the name of this group, whether by the "method of residues" or by application to the first species cited under it by its author.

crescentic in cross-section when moist, rigid and canaliculate or subconvolute on drying, dark-purple beneath, very obscurely areolate and porose above, solid in texture, the air-chambers almost wholly filled by secondary walls; scales small, purple, in a single series on either side of the costa, reniform or ovate, the anterior abruptly narrowed to a lanceolate or filiform reddish-purple point, which very rarely exceeds the apical margin: monoicous: androecia and ♀ branches on small latero-ventral innovations, those bearing a ♀ branch expanded, emarginate, bilobed or somewhat obcordate, 2–3 mm. long, 1–2.5 mm. in maximum width, with filiform-pointed inflexed scales at apex, androecium-bearing innovations smaller, scarcely expanded distally: ♀ receptacle subhemispherical, lightly papulose, becoming nearly smooth, 2–2.5 mm. in maximum width, with distinct and finally divergent lobes, maturing 1–4 (commonly 2 or 3) sporogonia, pilose-barbate beneath; pseudoperianth white, the exerted portion conical or conical-oblong, about 8-cleft, the segments often free with age; peduncle pale straw-colored, 1–1.5 cm. high, pilose at first, becoming naked: capsule circumscissile near the middle; spores brown, opaque, 75–90 μ , very minutely granulose papillate, the angles with a narrow concolorous margin, the faces exhibiting a few low ridges, these often uniting to form 2–4 shallow rather irregular areolae across each face, the more mature and opaque spores appearing simply warty-rugose in outline or subentire; elaters brown, 140–220 μ long, 15–21 μ in greatest width, bispiral, obtuse, occasionally branched.

Colomas, State of Sinaloa, Mexico (alt. 3000 ft.), (Dr. J. N. Rose, July 18, 1897); also, plants with quite immature sporogonia, by the same collector, in the Sierra Madre at Tepic, Mexico, Aug. 1897.

Asterella lateralis is an ally of *A. Bolanderi* (Aust.) Underw., but differs in the somewhat smaller ♀ receptacle, in the usually 8-cleft instead of 10–12-cleft pseudoperianth, and very markedly in the character of the spores and elaters—the spores of *A. Bolanderi* being deeply alveolate-areolate (4–6 meshes across each face) with a conspicuous pellucid margin, the elaters being 200–250 μ long and only 8–10 μ in width. As in *A. Bolanderi*, a tendency to dioicism is observed.

The only other species of *Asterella* with androecia and ♀ branches on small postical innovations known to us, outside of the American *A. Bolanderi* and *A. violacea*, are two species from

Africa, *Asterella linearis* (Steph.)* and *Asterella Preussii* (Schiffn.)† and one from Persia, *Asterella Persica* (Steph.),‡ which all differ (judging from descriptions alone) in being dioicous, while *A. Persica* evidently has a thicker thallus, being described as subsemicircular in transverse section, its scales are more prominent, the carpocephalum is 5–6-locular, etc.; *A. linearis* has geminately appendiculate scales, a highly papulose capitulum, and an almost fusiform pseudoperianth; and *A. Preussii* has scales attenuate at the apex into a very long hyaline seta, thicker thallus margins, a purple peduncle 25–30 mm. long, etc. The spores and elaters of these three exotic species are undescribed. The color and markings of the spores in this genus afford valuable characters, in the American forms, at least, for distinguishing species and these particulars have commonly failed to receive the attention that they deserve at the hands of authors. Spores that are nearly opaque in water often show the surface-sculpturing very clearly on examination in glycerine.

Exp'nation of Plates.

PLATE 336. *Scapania* (?) *heterophylla*. M. A. Howe.

1. An entire plant, $\frac{1}{3}$ the natural size.
- 2 and 3. Opposite views of a portion of the stem, showing the often three-ranked leaves, $\times 15$.
4. Dorsal view of stem and leaves, $\times 15$.
5. Ventral view of the same object, showing an unlobed underleaf, $\times 15$.
6. The leaf with lobes "a" and "a'" already shown in figures 4 and 5.
7. A typical underleaf, $\times 15$.
8. Outline of a deeply lobed leaf, $\times 15$.
9. Apex of a branch of the same plant from which figures 4 and 5 were drawn; leaves here distichous, $\times 15$.
10. The leaf "d" from the foregoing, $\times 15$.
11. Ventral view of a leaf, $\times 15$.
12. Cells from near base of leaf, $\times 244$.
13. Cells from the apical margin of one of the upper leaves, $\times 244$.
14. Paraphyses from axils of leaves, $\times 244$.
15. Cross section of the stem, $\times 32$.

PLATE 337. *Riccia trichocarpa*. M. A. Howe.

- 1 and 2. Portions of the plant, natural size.
3. Terminal segments of a young thallus, dorsal view, $\times 5$.
4. End of a thallus lobe from fig. 1, with ostioles and a sporogonium, $\times 10$.

* *Fimbriaria linearis* Steph. Engler's Bot. Jahrb. 20: 302. 1895.

† *Fimbriaria Preussii* Schiffn. Steph. l. c. 303.

‡ *Fimbriaria Persica* Steph. Hedwigia, 33: 7. 1894.

5. Lateral view toward apex of a thallus-segment, showing the numerous trichomes, $\times 20$.

6. Marginal trichomes, $\times 53$.

7. Portions of thallus exhibiting the trichome-bearing elevations above the capsules, $\times 20$.

8-13. Outlines of transverse sections about 10μ in thickness at selected points from near the apex to the old and shriveled base, $\times 23$. The trichomes do not appear so abundant as might be expected from the material used for microtome sectioning, which may be explained by the thinness of the sections and by the fact that the detached sections and fragments of the trichomes have not always adhered to the glass slides. Fig. 8 shows small median scales.

14. Epidermis and subjacent cells from a younger portion of the thallus, $\times 225$. The superficial layer is here represented as composed of collapsed cells. In the extreme apical region only they are papilliform.

15. Epidermis in older parts of the thallus, $\times 225$. The collapse and disintegration of the cells of the outer layer is so complete that only a structureless cellulose film remains.

16. Cross-section of thallus showing the cell structure and a young sporogonium, $\times 53$.

17. Spores, $\times 305$.

Figs. 1, 2, 4-7 and 17 from Hep. Am. no. 138 collected in San Mateo County, California, April, 1892, by Prof. D. H. Campbell; figs. 3 and 8-16 from material fixed with 1 per cent. chromic acid and preserved in alcohol, collected by the author near Berkeley, California, February 8, 1896.